Review of 2002 Stock Assessment for

Large Coastal Sharks

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Independent Reviewer #2

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Executive Summary

This review covers material (methods, results and recommendations) contained in both the 2002 Shark Evaluation Workshop Report (SEW) and the subsequent 2002 Stock Assessment (SA). The evaluation was based on a careful review of these documents and the accompanying background literature. In addressing specific items contained within the Scope of Work, particular emphasis was placed on evaluating the way in which the 2002 SEW and 2002 SA responded to the recommendations of previous independent reviews of the 1998 SEW.

I find the 2002 SEW to be a good faith effort by NMFS to address the various criticisms and concerns that were raised regarding the methods, results and recommendations of 1998 SEW. The scope of work of the various 2002 SEW working groups represented a logical approach to providing the best available scientific data for the various analyses and their subsequent interpretation. The current analyses incorporated several substantive changes or additions to those of the 1998 SEW. Many of these changes were in accord with the suggestions of previous reviewers and included age-structured models, models that consider delayed recruitment of animals into the fishery and models that attempt to capture the potential differences in responses to exploitation of open versus

closed populations, among others. Recently acquired biological data (e.g., juvenile survival rates) were incorporated into the analyses. Also, considerable effort was expended in trying to reconstruct historical catch rates to provide longer time series. As suggested by reviewers of the 1998 SEW, sensitivity analyses were applied to the results of the various models. In the 2002 iteration, the weighting and importance functions are explicitly described as are the other criteria used for evaluating which results make 'more sense' than others do. As suggested by commercial shark fishing interests, estimates of the Mexican catch were incorporated into the models.

The 2002 SEW and the Stock Assessment are scientifically rigorous bodies of work. These exhaustive attempts to include the multiplicity of recommendations from previous reviews are almost self-defeating; so many permutations were considered that the assessment document is cumbersome and difficult to digest. Fortunately (or unfortunately), there is an overwhelming consistency to the results; the LCS resources of the Western Atlantic and Gulf of Mexico have been exploited beyond sustainable rates and populations are at or below levels required to sustain MSY. Recent management restrictions may have halted the decline in these stocks but current exploitation rates will not stabilize them at (or allow them to rebuild to) MSY levels. These results are consistent with the results of the 1998 SEW. The reliability of the models and their pertinence to stock management continue to be impacted by the paucity of historical catch data and uncertainty about the reliability of certain data sources. However, I find that the catch levels recommended in the 2002 Stock Assessment follow logically from the results that were presented in the document especially when viewed in light of the Precautionary Approach to resource management. To improve future stock assessments, NMFS should support on-board observer programs and programs (e.g., VIMS, Mote, NMFS-Mississippi) that acquire fishery independent estimates of abundance. Movement and habitat utilization research should be high priorities.

Background

Following legal challenges to the technical quality of the stock assessments and the resultant management recommendations for LCS resources of the Western Atlantic and Gulf of Mexico contained in the 1998 SEW Report, the court required that the 1998 SEW Report and its findings be subjected to independent review. Two rounds of these reviews were conducted. These reviews are referred to in the current scope of work as the CIE and NRC reviews. The court also required that the next NMFS stock assessment and its recommendations be evaluated by independent reviewers and that those reviews be made available to NMFS and the court. The next assessment to be conducted by NMFS was the 2002 SEW. The report contained herein is a part of the court-ordered independent review of the 2002 SEW Report and the subsequent assessment document "Stock Assessment of Large Coastal Sharks in the U.S. Atlantic and Gulf of Mexico" by Cortés, Brooks and Scott, NMFS Sustainable Fisheries Division Contribution SFD-02/03-177.

Description of Review Activities

The Scope of Work for the current review requires an evaluation of certain aspects of the contents of the "2002 SEW Report." However, the results of the

various stock assessment models and the resulting interpretations and management recommendations are actually contained in a subsequent document published in September 2002 entitled "Stock Assessment of Large Coastal Sharks in the U.S. Atlantic and Gulf of Mexico" by Cortés, Brooks and Scott, NMFS Sustainable Fisheries Division Contribution SFD-02/03-177. For the purposes of this review, I have assumed that the scope of work is intended to cover this document (which I will refer to as 2002 SA) *and* the 2002 SEW Report.

The evaluation process consisted of careful review of the 2002 SEW Report and the 2002 Stock Assessment and the supporting literature. Particular attention was paid to the comments contained in the two series of independent reviews and the way their suggestions were incorporated into the 2002 SEW and 2002 Stock Assessment. In the body of the review text I have paraphrased each item in the Scope of Work to allow the reader to identify which specific item I am addressing.

The deliberations and recommendations of the 1998 SEW received extensive expert independent review (CIE and NRC) and comments from the commercial shark fishing sector. These reviews comprise part of the supporting literature (Appendix A) provided for the current evaluation of the 2002 Shark Evaluation Workshop Report (2002 SEW). The combination of the 1998 and 2002 SEWs and the independent reviews constitute a comprehensive and wide ranging discussion of scientific questions and management issues involving the LCS resources of the Western Atlantic and Gulf of Mexico and it is not necessary to recapitulate that information in this review. For this reason, and because of the comparatively brief time available to conduct this review, I will limit my responses to the specific items listed in the current Scope of Work. Further, in a commendable response to requests for more detailed explanations of ways in which the assessments were constructed and for expanded access to the source data, the 2002 SEW Report and the subsequent Stock Assessment contain exhaustive discussions of the various options and present many tables of data. Consequently, for the purposes of this review, I will refer the reader to the 2002 documents for detailed treatments of the specific issues discussed below.

I feel it is essential to preface my evaluation of these specific items with a brief general discussion of the 2002 SEW and 2002 SA reports. This will serve to augment my subsequent responses to the specific items in scope of work.

I find that the 2002 documents represent a good faith effort to incorporate virtually all the recommendations contained in the reviews of the 1998 SEW, even when several of these reviews come to different conclusions and sometimes contain contradictory recommendations. In attempting to cover all bases, the current SEW and SA present five different models, each of which assess three different catch scenarios that in turn have several different variations! This makes for a large and complex document that discusses the pros and cons of virtually all the points that have been raised since 1998. This inclusiveness should satisfy the suggestions of those independent reviewers who felt that more detail should be provided in the assessment documents. Further, there is extensive discussion and debate of virtually all the options that were considered in compiling and evaluating the various catch statistics and the assessment models used. In my opinion, it would be difficult for the NMFS to be more

transparent or exhaustive in describing how the 2002 assessment was conducted or how it arrived at its recommendations. Some sections of these documents are exceptionally well written and lucid.

There were some recommendations that were common to several independent reviews and that have been adopted in the models used in the current assessment. These include age-structured and space-structured models, sensitivity analyses and much more detail regarding the weighting protocols used in the models. Further, the 2002 analyses take into account suggestions received from the commercial fishing industry such as including Mexican catches in the analyses. Also, the 2002 analyses were conducted 'in house' by NMFS rather than by NGOs that might be perceived as having an excessive conservation bias.

Nevertheless, the perceived necessity to expand the assessment from1998 levels to include multiple alternative models and data scenarios serves to highlight an important and recurring theme: namely, the paucity, unevenness and potential unreliability of the catch data on which these various analyses are based. These data problems are recognized by previous reviewers and are discussed throughout the 2002 SEW. Of course, this same uncertainty in data quality ripples through the various assessments and makes them vulnerable to the court challenges that have resulted in the court-ordered independent reviews. Given the universally acknowledged problems with the catch database, it is unfortunate that the management of a heavily exploited resource seems to have been sidelined by an academic discussion of the niceties of different assessment models.

> Specific Item 1. *How was the appropriateness of specific modeling approaches determined for assessing large coastal sharks, a long-lived species (or species complex), including consideration of alternative modeling approaches and the approaches employed in prior shark evaluation workshops?*

The underlying yardstick of the appropriateness of all the models used in this assessment was the ability of the models to capture the trends in the various catch and CPUE data series. This is standard practice in this type of fisheries stock assessment and is entirely appropriate in this setting. Using this yardstick, different models and iterations of the same model that incorporate various aspects of the biology and exploitation of the species under consideration can be tested. Bayesian modeling techniques allow incorporation of life-history parameters (such as recently estimated juvenile blacktip survival) into the stock assessment process and the independent reviewers endorsed their use in these analyses. Another common theme in the independent reviews was the need to incorporate age-structured models into the assessment process and to test models that take into account a lag time between birth and recruitment into the fishery. This lag may occur with slow growing sharks or sharks that have different juvenile and adult habitats (as in the case of several species, including blacktip and sandbar) and thereby encounter different gears at different life stages. The incorporation of age and lag-structured assessment models represents a major departure (and improvement) from the 1998 assessment process. Other

significant changes from the 1998 assessment process are summarized on Page 9 of the 2002 Stock Assessment document and a useful and concise summary of the various models is contained in Table 9 of the 2002 SEW Report. Although incorporation of the age and space structures into these analyses did not substantially alter the 1998 results and recommendations, intellectually this is the more rigorous approach and it should become standard practice. Although their precise movements may not yet be known, all the species of LCS are migratory and future management assessments should consider TACs tailored to different regions of the normal distribution (range) of the various LCS species.

> Specific Item 2. *How were the availability and quality of alternative catch and catch rate data sets considered, How were they weighted and applied in an age-structured context? Were the best available data used in the 2002 SEW and how were the recommendations of previous reviews addressed?*

Considerable effort was expended in the 2002 SEW to supply the various models with different permutations of the available catch and catch rate data sets. *Updated, Baseline* and *Alternative* catch series scenarios were constructed using catch data obtained since the 1998 SEW (i.e., 1997-2001) and additional catch data sets were incorporated into all the data scenarios. The updated series basically replicated the series used for the 1998 SEW and added the catch data for between 1997 to 2001. Congruent with suggestions from industry and independent reviewers, catch estimates of the Mexican fishery and estimates of discards from the menhaden fishery were added to the *background* scenario. And, in an attempt to provide longer time series against which to test the models, the alternate scenario included attempts to reconstruct historical catch rates. The rationale behind the various scenarios is clearly described in both documents and the various catch data series are summarized in Table 8 of the 2002 SEW.

These three different catch and catch rate scenarios are good faith attempts to extract as much information as possible from sparse and inconsistent data obtained from disparate sources. The inclusion of these additional catch estimates in the 2002 *baseline* and *alternative* scenarios (historical discards, estimates of the Mexican catch, etc.) are the best available approaches to determine if the resilience of the resource and its intrinsic rate of recovery are more optimistic than the 1998 evaluations would indicate. However, even though the methods of deriving these catch estimates are clearly presented in the base documents accompanying the 2002 SEW, I have misgivings about the reliability of these estimates. In some cases, these *post facto* estimates are being constructed from 'raw' sources of data that were not originally designed for shark stock assessment purposes (e.g., logbook data) or which use were not objectively verified at the time they were collected. Even with the personnel and funding resources available within the U.S., there are significant problems with the U.S. catch data (even within the past ten years) and so it stretches credulity that data derived from official Mexican government records can represent anything other than a gross overview of the Mexican fishery. These concerns are also mentioned in the 2002 SEW (Page 7, *inter alia*) and various independent reviews.

Consequently, for my own evaluation of the performance of the various models, I placed emphasis on how well they captured fishery dependent catch series data derived from on-board observers or from fishery independent sources (e.g., VIMS, Mote and NMFS Mississippi). In most cases, these are data collected in the past ten years. In other words, I paid close attention to the data sets and model results displayed in panels B and C of Figures 1 through 24 of the 2002 Stock Assessment document and the pertinent panels in Figures 27 through 49.

The desirability of assessing the impact of different weighting protocols on the performance of the various models was another the themes that was mentioned by several of the independent reviewers. In a significant change from the 1998 SEW, multiple weighting strategies were used in the 2002 SEW models. An excellent treatment of the pros and cons of the various weighting strategies and why each of the various weighting methods was selected can be found in the section "*Decision about weighting methods for CPUE series*" in the 2002 SEW (Pages 41-43). Basically, the 1998 decision to use only the commonly used inverse variance weighting method to evaluate various CPUE series may bias the models towards CPUE series that were larger and possibly more consistent (for example fisheries dependent data) than fisheries independent series that are frequently more variable (e.g. the VIMS data). The 2002 SEW responded affirmatively to the advice of independent reviewers by incorporating several weighting methods in the latest series of models.

In my opinion, the 2002 SEW and assessment used the best scientific data available at the time of the assessment and the assessment embraced the suggestions of a large number of external commentators. In addition to examples already discussed, there are other indicators of the rigor and responsiveness of the 2002 assessment process. The scopes of work for the Working Groups ('Catch', 'CPUE' and 'Methods') described in the 2002 SEW indicate a logical and effective method for acquiring, analyzing and integrating information available for inclusion in these assessments. Recently acquired and re-worked catch data (e.g., age-structured) were included in the various catch scenarios and recently acquired biological data were inserted where appropriate. An example is the re-parameterization of the Beverton Holt stock recruitment function to include the use of empirically measured pup survivorship (S_0) rather than a steepness function *z* (2002 SEW, Pages 45 and 54). Importantly, intrinsic rates of increase (*r*) derived from demographic methods were used in fitting some of the models. These r values were presented in a peer-reviewed paper indicate that *r* values used in the 1996 SEW were too large and, by extension, support the more pessimistic stock assessments adopted by the 1998 SEW.

> Specific Item 3. *How were the selected modeling approaches applied to the data chosen for the analyses? How was information handled relating to whether or not the large coastal species under consideration represent closed or open populations? How was discard was mortality accounted for in setting landings quotas based on this assessment?*

As previously stated, the various models were applied to the different catch scenarios and evaluated for their ability to fit the values and trends in the

various catch data series. This is standard practice in fisheries assessment. The results of the various permutations of model and catch database are explicitly described in the text and in the copious figures of SEW 2002.

The 1998 and 2002 SEW reports, the independent reviews and the comments from commercial fishery representatives acknowledged that assessment approaches and management strategies for the US fishery for LCS might differ depending on whether the LCS resource is an 'open or closed' population. Data concerning the range of the stock (e.g., from tag-recapture or electronic tagging experiments) are limited and acquiring these data in future should receive a high priority. Despite the paucity of empirical data, the 2002 SEW included efforts to address the open/closed population question. Independent reviews also addressed this question and CIE reviewer Dr. André Punt, constructed a model to evaluate the impact of a second 'hidden' unfished shark population that supplied immigrants to the fished population. Inclusion of estimates of Mexican catches was also an attempt to account for the possibility that LCS species occupied ranges that extended beyond the geographic bounds of the U.S. fishery. Despite my doubts (and some of the 2002 SEW participants) about the reliability of the Mexican data, including these data in some of the analyses seems a reasonable option at this point in time.

In the meantime, several reviewers (including me) feel that at least for sandbar and blacktip sharks, the U.S fishery is exploiting an essentially closed population. Preliminary analyses of tag recapture data from the NMFS Cooperative Shark Tagging Program (SB-02-24) indicate that for blacktip sharks, only the US fishery occurring in the western regions of the gulf of Mexico exploits sharks that spend time in Mexican waters and preliminary analysis of tag data for sandbar sharks indicate that only 3.96% of the sandbar population might be living in Mexican waters (5B-02-1, Annex 1).

Even if there are violations of the strict closed population assumption, sensitivity analyses conducted by CIE reviewer Vivian Haist indicate that violation of the closed population assumption does not change the interpretation that catches at the 1997 level were exceeding MSC. Further, since these species constitute a very large part of the total U.S. catch, it is reasonable to apply the 'closed population' descriptor to analyses of the large coastal shark complex until such time that species specific data can be acquired for the other species in this complex. This perspective is supported by the fact that inclusion of the Mexican data or including assumptions of immigration from external sources (for example, by allowing unrealistically high values of r) have little impact on the assessment models or their projections for the recovery of the resource. The results of the models tested by Dr. Punt also "do not provide evidence for substantial immigration effects". The age-structured, two-area analysis of shark population dynamics also indicated that the results were not sensitive to movements between U.S. and Mexican waters (SB-02-1).

It is to be hoped that in the near future, fishery independent data from various electronic tagging experiments and genetic analyses will elucidate the extent of the range of these species and their movement patterns within this range. The 2002 SEW identifies electronic tagging experiments as one of the priorities for future research. Given the high exploitation rates of these populations and given

recurring problems with long-term external attachment of electronic tags, internally implanted archiving tags would be the best way to acquire information about the long-term movement patterns of these sharks. Through the long running Cooperative Shark Tagging Program, NMFS is in already in possession of quite a large tag-recapture database for several of the target shark species. I am surprised that documents SB-02-24 and 5B-02-1, Annex 1 are apparently the first attempts to apply these data to the 'open' versus 'closed' population management debate.

The 2002 SEW responded to external comments by incorporating and testing the impact of the menhaden fishery shark discard data on the modeled assessments. A subset of analyses addressed the impact of the estimates of dead discards in the menhaden fishery and performed sensitivity tests to determine the impact of these dead discards in the *alternate* catch scenario. The details and rationale for these estimates are given on Page 9 of the 2002 Stock Assessment. By including these discard data in some of the catch series that were evaluated by the various models, the 2002 SEW process provided a mechanism for incorporating the potential impact of shark discards into the final management recommendations.

> Specific Item 4. *How were the reliability of projections evaluated based on the above three considerations?*

There would seem to be three ways of responding to this question. First, from a technical standpoint, the reliability of the models was evaluated with various statistical tests. These included convergence and CV diagnostics for the various models and evaluation of the impact of various weighting protocols on the performance of the models. The various strategies are described in the 2002 assessment document.

Second, in terms of evaluating how reliable the overall conclusions of the assessment are, the approach used in the 2002 evaluation process was to use multiple models (five) with multiple catch scenario inputs and to then interpret the model outputs (projections) with a decision analysis protocol. This decision protocol allowed for even more alternative scenarios to be considered when evaluating at what point the various stocks might return to levels that could support MSY. This approach allows a 'summarizing' of the similarity of the results of the multiple model runs and the basing of management recommendations on the balance of these results. For stock status, these output summaries are presented effectively in figures 71 to 77. I think this is an entirely reasonable way to present and evaluate the current stock analyses.

The third way of answering the 'reliability' question is to reiterate that these models are only as good as the data that are used in the analyses. No matter how elegant the model used, no matter how strictly the rules of the models are observed, the outputs are only going to be as reliable as the input data. Given the short time span of the catch record and the previously mentioned uncertainties of the catch data, current analyses of the status of LCS are never going to be surgically precise. This uncertainty validates the 'summary' and 'on balance' approach used in 'summary' and 'recommendations' sections of the 2002

assessment.

Specific Item 5. *How were the effects of a range of catch scenarios (including the effects of current regulations on stock trajectories) evaluated?*

My responses to Specific Item 4 (above) apply equally to Item 5. The various catch scenarios were evaluated using multiple modeling approaches. This allows an overall summary evaluation of the impact of the various catch scenarios (and other permutations such as using only fishery dependent or fishery independent series) on the assessment results. The impact (if any) of current regulations are reflected in the values and trajectories of the catch records that were used as inputs for the various assessment models and, as such, formed part of the data base that was used in the 2002 assessment.

Specific Item 6. *Were candidates for prohibited species status considered status considered, including whether the species on the existing prohibited species list are appropriate?*

The prohibited species list was given the least attention in the 2002 SEW and the subsequent 2002 Stock Assessment although there was considerably more discussion of this topic in the 1998 assessment. The only substantive addition to the 1998 position was reference to the paper published in 1998 by Smith et al. NMFS will need to be more expansive in its explanation of the status of the prohibited species list when any future management plans are published.

Summary of Findings, Conclusions and Recommendations

In my opinion, the 2002 SEW and subsequent 2002 Stock Assessment represent commendable efforts to rigorously analyze the status of the LCS resources and to incorporate the suggestions of the multiple reviews of the 1998 SEW. Whatever the missteps of the past, these documents portray a desire to 'put all the cards on the table' and expose the assessment process to full scrutiny. The assessment techniques are appropriate, exhaustive and rigorous.

Taken on balance, the stock assessments indicate that the LCS resource is extremely heavily exploited and that additional reductions of catch are warranted. Given that, on balance, the preponderance of the plausible models indicate that current catch levels exceed MSC and that stocks are probably below those necessary to support MSY and, given that fisheries management policy should adopt the Precautionary Approach to resource management, I find the phrasing of the recommendations in section 4.1.1 of the 2002 Stock Assessment to be rather timid. The LCS species of the western Atlantic and Gulf of Mexico represent a legitimate resource for commercial exploitation. However, by any measure, this is a resource that is teetering on the edge of sustainability. The problematic nature of the catch record and the Precautionary Approach to resource management indicate that NMFS should err on the side of the resource.

I recommend that the findings of the 2002 SEW and 2002 Stock Assessment be accepted as a scientifically legitimate basis for formulation of LCS management

policy and that the recommendations for future research activities outlined in Section 6 of the 2002 SEW be supported by NMFS and other pertinent agencies. Particular attention should be paid to acquiring an improved understanding of the range of distribution and movements of the stock and in establishing measures to protect juvenile sharks and their habitats.

Appendix A. Required literature

Review

2002 Report of the Shark Evaluation Workshop.

NOAA Fisheries. Final Meeting Report for the 2002 Shark Evaluation Workshop. August 20, 2002.

Previous Reviews

1998 Report of the Shark Evaluation Workshop.

NRC, Inc. Independent review of the scientific management recommendations in the June 1998 large coastal shark evaluation workshop report. October 10, 2001.

Haist, V. Center of Independent Experts. Review of Atlantic large coastal sharks assessment. September 27, 2001.

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Punt, A.E. Center of Independent Experts. Review of the Assessments of and Management Advice for Atlantic Large Coastal Sharks. September 16, 2001.

Background Documents

SB-02-1. Apostolaki, A., E.A. Babcock, M.K. McAllister, and R. Bonfil. Assessment of large coastal sharks using a two-area, fleet-disaggregated, age-structured model.

SB-02-2. Babcock, E.A. The effectiveness of bag limits in the U.S. Atlantic recreational fishery.

SB-02-3. Bonfil, R. and E.A. Babcock. Estimation of catches of sandbar (Carcharhinus plumbeus) and blacktip (C. limbatus) sharks in the Mexican fisheries of the Gulf of Mexico.

SB-02-4. Brooks, E. Maximum likelihood estimation of shark abundance.

SB-02-5. Brooks, E., C. Porch, and E. Cortes. An age-structured production model (ASPM) for application to large coastal sharks.

SB-02-6. Brown, C.A. Updated standardized catch rates of four species of sharks in the Virginia-Massachusetts (U.S.) rod and reel fishery.

SB-02-7. Brown, C. and J. Cramer. Large pelagic logbook catch rates for sharks.

SB-02-8. Carlson, J.K. A fishery-independent assessment of shark stock abundance for large coastal species in the Northeast Gulf of Mexico.

SB-02-9. Carlson, J.K. The directed shark gillnet fishery: characterization of the large coastal shark catch and a standardization of catch rates from observer data.

SB-02-10. Carlson, J.K. and I. Baremore. Biological parameters for the blacktip shark, Carcharhinus limbatus, from the US South Atlantic Ocean and Gulf of Mexico.

SB-02-11. Cortes, E. A simplified Bayesian delay-difference model: application to large coastal sharks.

SB-02-12. Cortes, E. Catch rates of large coastal sharks.

SB-02-13. Cortes, E. Incorporating uncertainty into demographic modeling: applications to shark populations and their conservation.

SB-02-14. Cortes, E. Sensitivity analysis of the 1998 Large Coastal Shark Evaluation Workshop results to new data and model formulations following recommendations from peer reviews.

SB-02-15. Cortes, E. and J.A. Neer. Updated catches of sharks.

SB-02-16. Grace, M., T. Henwood, and W. Ingram. Fishery independent catch rate statistics for large coastal sharks in the western North Atlantic Ocean as derived from bottom longline surveys.

SB-02-17. Heupel, M., and R.E. Hueter. Use of an automated acoustic telemetry system to passively track juvenile blacktip movements.

SB-02-18. Heupel, M., and C. Simpfendorfer. Estimation of mortality of juvenile blacktip sharks, Carcharhinus limbatus, within a nursery area using telemetry data.

SB-02-19. Hudson, R.H. Tag recapture data by area for sandbar, dusky, and blacktip sharks from Kohler, et al. (facsimile from N.E. Kohler).

SB-02-20. Hudson, R.H. 1998 letter from Steve Branstetter (NMFS) to Richard Condrey (LSU) on methodology for calculating bycatch in the Gulf menhaden fishery.

SB-02-21. Heuter, R.E. Early life history and relative abundance of blacktip and other coastal sharks in eastern Gulf of Mexico nursery areas, including bycatch mortality of sharks and associated fishes.

SB-02-22. Heuter, R.E. and J. Tyminski. U.S. shark nursery research overview.

SB-02-23. Heuter, R.E. and J. Tyminski, and C. Simpfendorfer. Relative

abundance of juvenile blacktip sharks in two Florida Gulf nursery areas (1995-2001).

SB-02-24. Kohler, N.E. and P.A. Turner. Tag and recapture data for the blacktip shark, Carcharhinus limbatus, in the Western North Atlantic.

SB-02-25. McAllister, M.K. E.A. Babcock, R. Bonfil, and E.K. Pikitch. Importance sampling issues in the 1998 large coastal shark assessment.

SB-02-26. McAllister, M.K. and E.A. Babcock. Bayesian surplus production model with the Sampling Importance Resampling algorithm (BSP): a user's guide.

SB-02-27. McCandless, C.T., H.L. Pratt, and N.E. Kohler. Monitoring the juvenile sandbar shark, Carcharhinus plumbeus, population in the Delaware Bay nursery grounds. **[Authors did not submit to the SEW]**.

SB-02-28. Musick, J.A., and C.L. Conrath. A delineation of shark nursery grounds in Chesapeake Bay and an assessment of abundance of shark stocks (2001-2002).

SB-02-29. NMFS. 1996 Report of Shark Evaluation Workshop.

Sb-02-30. NMFS. 1998 Report of Shark Evaluation Workshop. **[Duplicate of document listed under Previous Reviews.]**

SB-02-31. Porch, C.E. A preliminary assessment of Atlantic white marlin (Tetrapturus albidus) using a state-space implementation of an age-structures production model.

SB-02-32. Romine, J.G., J.A. Musick, and G.H. Burgess. An analysis of the status and ecology of the dusky shark, Carcharhinus obscurus, in the Western North Atlantic.

SB-02-33. Brown, C.A. Bottom longline logbook catch rates for large coastal sharks.

SB-02-33R. Brown, C.A. Bottom longline logbook catch rates for large coastal sharks (Revised).

SB-02-34. Heinemann, D. and J. Poffenberger. Summaries of Gulf of Mexico and Southeastern US Atlantic shark catch and fishing effort from coastal fishery logbook reports.

SB-02-35. Burgess, G. Directed shark longline fishery observer program: miscellaneous information.

SB-02-36. Springer, S. Natural history of the sandbar shark, Eulambia milberti.

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SB-02-40. Rester, J.K. and R.E. Condrey. Characterization and evaluation of bycatch reduction devices in the Gulf Menhaden fishery.

SB-02-41. McAllister, M.K., E.K. Pikitch. And E.A. Babcock. Using demographic methods to construct Bayesian priors for the intrinsic rate of increase in the Schaefer model and implications for stock rebuilding.

Historical Documents

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Final report of the Atlantic coastal shark fishery analysis review. September 30, 1992. Appendix II to the 1993 Fishery Management Plan for Shark of the Atlantic Ocean.

Atlantic Shark Industry Position Statement, January 10, 2001.